Modeling and Simulation for Acquisition, Requirements and Training: The Army SMART Model

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Michelle T. Bevan
IIT - Research Institute
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Simulation Based Acquisition (SBA)

Definition of SBA

An *iterative, integrated product and process approach to acquisition*, using modeling and simulation, that enables the warfighting, resource allocation, and acquisition communities to fulfill the warfighter's material needs, while maintaining *Cost As an Independent Variable* (CAIV) over the *system's entire lifecycle* and within the DoD's *system of systems.*

SBA: A New Approach, 1997-1998, DSMC Military Research Fellows

SBA Vision & Goals

Vision

...to have an Acquisition Process in which DoD and Industry are enabled by robust, collaborative use of simulation technology that is integrated across acquisition phases and programs.

Goals

- Substantially reduce the time, resources and risk associated with the entire acquisition process;
- Increase the quality, military worth and supportability of fielded systems, while reducing their operating and sustaining costs throughout the total life cycle;
- Enable Integrated Product and Process Development (IPPD) across the entire acquisition lifecycle.

SBA Special Interest Area www.msiac.dmso.mil/sba/

SBA Roadmap Presentation, Robin Frost, SIW Spring 99

SBA is SMART for the Army*

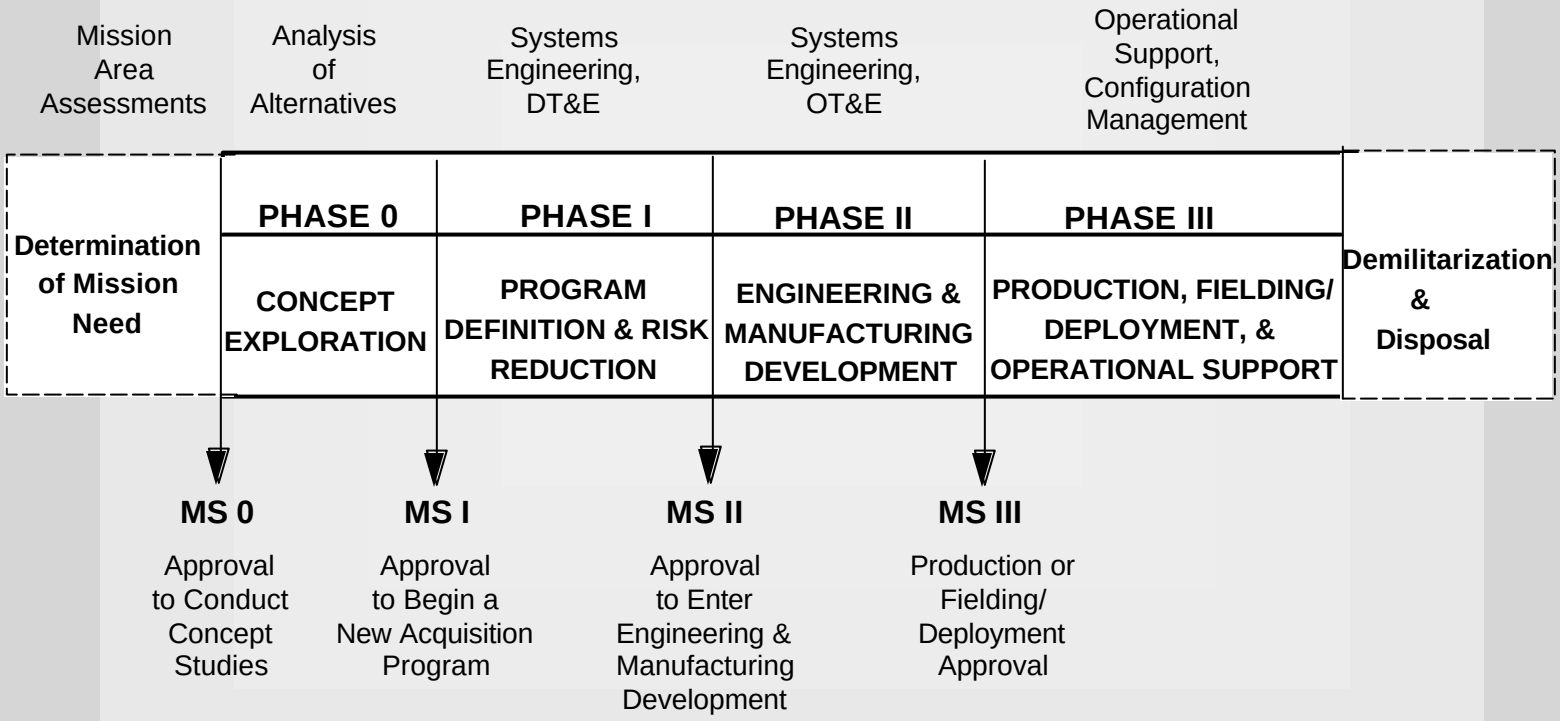
"SBA is an Office of the Secretary of Defense (OSD) initiative to *reform the acquisition process* so that the acquisition community *uses* modeling and simulation *(M&S)* robustly throughout the acquisition life cycle. The goals of SBA are to *reduce* the *time to field systems*, reduce *total costs*, and *increase the military utility of fielded systems*. These goals are of primary concern to the Army, but we recognize that we cannot achieve them through the efforts of the acquisition community alone. It requires the *combined*, integrated *efforts* of the *Acquisition Workforce* along with the *requirements* and *training communities*, hence the name SMART."

***From an article of the same name by LTG Paul J. Kern and Ellen M. Purdy, RDA Magazine, May 1999**

Acquisition Life Cycle:

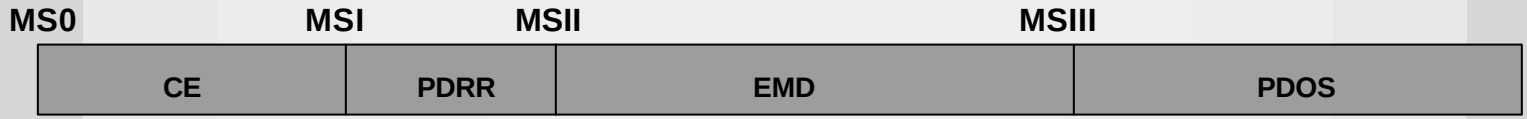
The Traditional View

Major Phase Activities

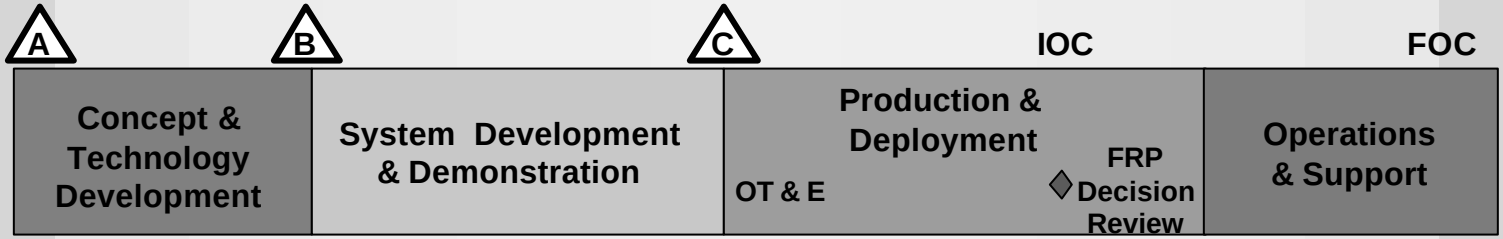


New Acquisition Process

OLD:



NEW:



Pre-Systems Acquisition

Systems Acquisition (Engineering & Manufacturing, LRIP & Production)

Sustainment

DoDI 5000.2; Operation of the Defense Acquisition System; 23 October 2000

Iterative Acquisition Process

Prove Military Need
Use Suite of Models to Emulate battlefield

Pre Milestone 0

Milestone 1

Test Concepts
"Real World" of simulation injecting warfighter into process

Refine Requirements
- Get user involved
- Prevent "gold plating"

Milestone 2

Reduce Program Risks
- Design
- System Integration
- Transition to Production
- Testing

Milestone 3

Transition Smoothly to Field
- Manual Proven
- Trained personnel
- Doctrine Ready *Before Equipment Arrives in field*

Simulation and Reform of the Acquisition Process. Adapted from Shiflett et al. (1995)

The SMART Model

3 Components:

- *Process* - Iterative and 'model-test-model' rather than 'test-fix-test'. *HOW?*

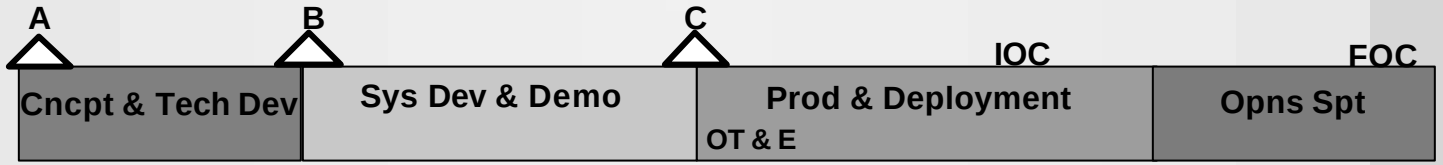
- *Environment* - Collaborative, seamless, web-oriented. *WHERE?*

- *Culture* - Integrated teams, changing roles and responsibilities. *WHO?*

SMART Process

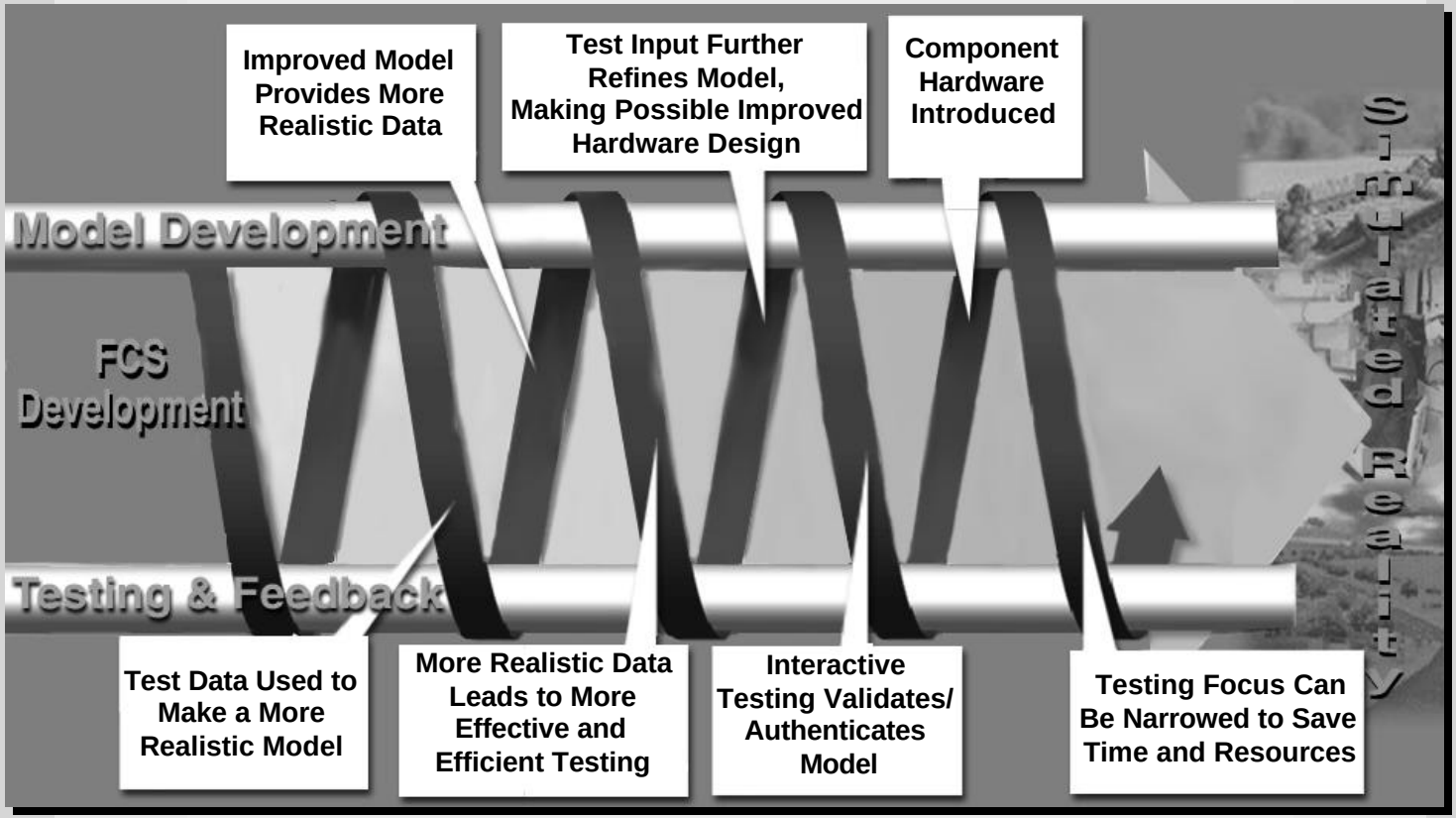
- Integration of:
  - *Requirements*
  - *Functional Design*
  - *Implementation Design*

Throughout the Lifecycle
Technology Insertion at Any Point
Reusing Data from Previous M&S



- Rapid Evaluation of Multiple Options
- Electronic Exchange of System Models
- Iterative, spiral process

Spiral Development



LTG Paul J. Kern Presentation to Army Test and Evaluation Days, 7/26/00

SMART Environment

- Collaborative, distributed engineering
- Information Repository
- User Transparent Web-style Access

Crusader Example:
Integrated Data Environment:

The Army's Next Generation
Self Propelled Howitzer (SPH) and
Resupply Vehicle (RSV)

SMART Culture

- Changing Roles and Responsibilities
- Enabled Integrated Process Teams
- Using M&S Data Through the Acquisition Lifecycle

Comanche (RAH-66) Example:
Integrated Data Teams

Boeing/Sikorsky/Government

SMART Difference

Drafting Board

Wind Tunnel Tests

Construction in Plant

Test & Evaluation

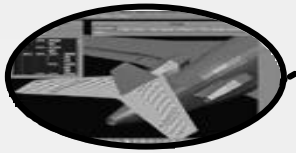
Traditional Mock-up & Full Scale Prototyping

- **Employs excessive personnel and facilities**
- **Time consuming & expensive**

Sensor Team

T&E Team

Airframe Team

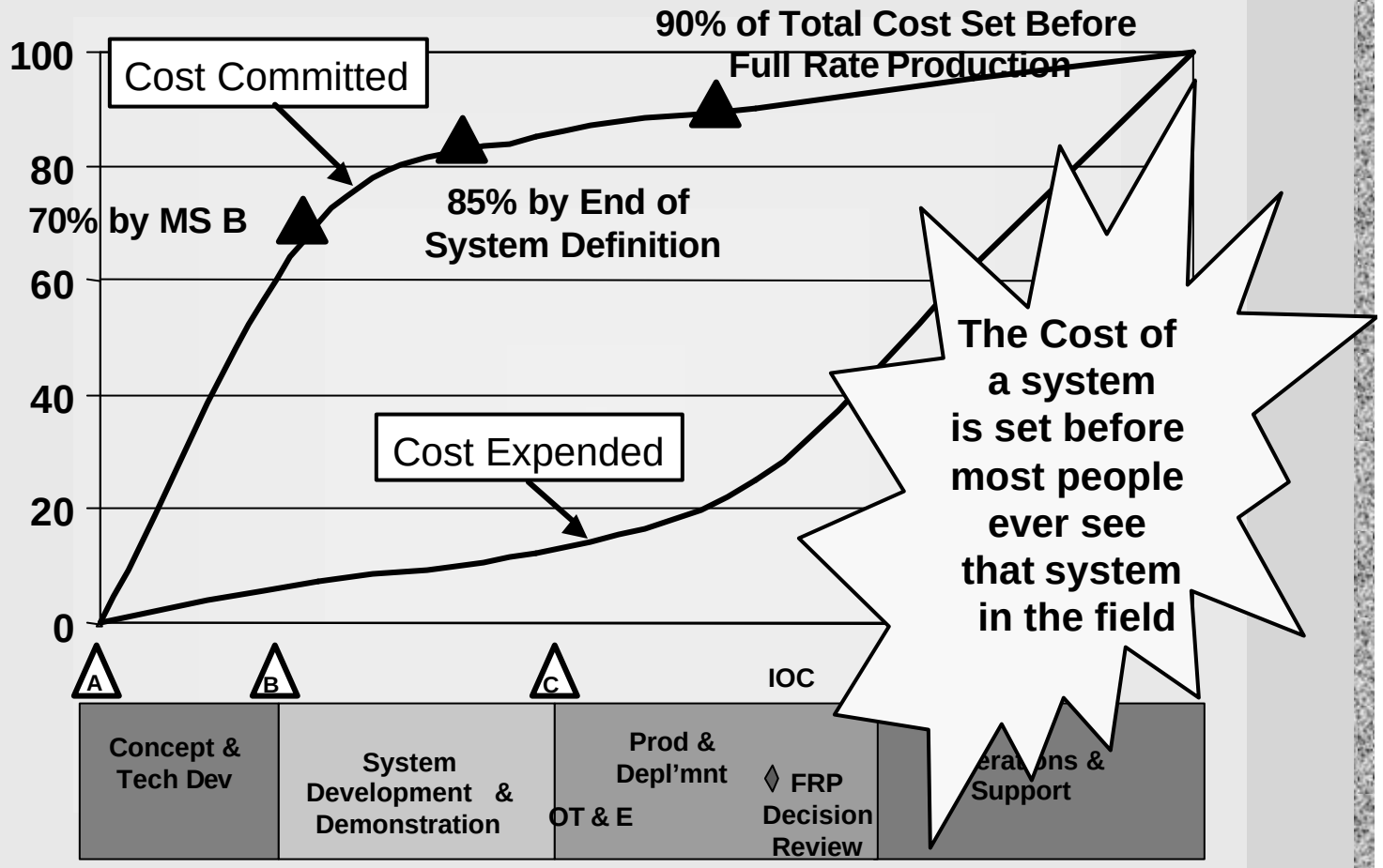


Production Team

Collaborative Virtual Prototyping

- **Employs latest technology**
- **Investigates unlimited design options**
- **Reduces cost & improves time to first article**

Where Is Cost Determined?



M&S in Acquisition

Pre-Milestone A

Extended Air Defense Simulation (EADSIM)

Mission Area Assessments
Use suite of models & simulations

Mission Need Statement (MNS)
Use campaign & theater level models in conjunction with results of lower level models

EADSIM is an example of a constructive model at the mission level.

M&S in Acquisition

Concept and Technology Development

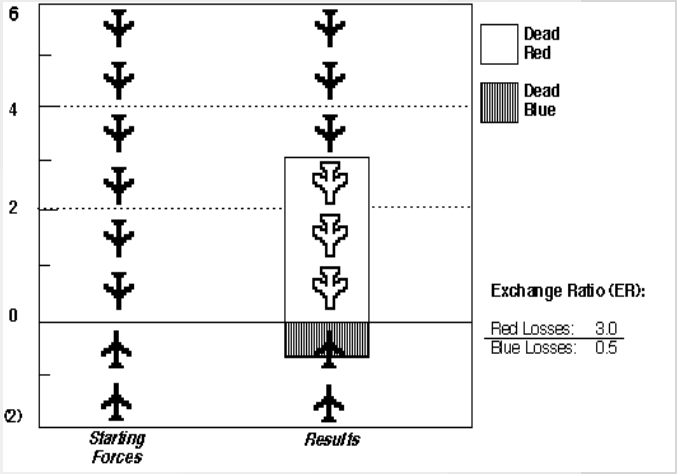
ORD Generation
Use operational effectiveness & supportability models
Use threat models

Analysis of Alternatives
Use cost & operational effectiveness models
Use support models

RFP
Specify government-owned M&S products
Identify M&S requirements

System Cost Elements
Use cost models (program & life cycle)

Program Planning
Use schedule, risk, plans models



BRAWLER, a constructive model at the engagement level, can be used in all phases of acquisition to predict system performance.

iac.dtic.mil/surviac/prod_serv/model_guide/brawler.html

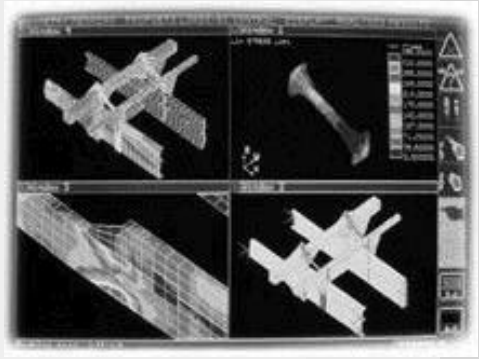
M&S in Acquisition

System Development & Demonstration

Acquisition Strategy
M&S Strategy
Use repository
VV&A

Systems Engineering
Use Engineering M&S of proposed systems for specification development
Use HW/SW-in-the-loop for design evaluation & risk reduction
Use CAD/CAM for design & producibility planning
Use support & operational models to evaluate logistics/combat support concepts& plans

TEMP
Plan M&S applications to be used in DT&E, OT&E
Plan use of DT&E to validate models
Establish test facility M&S compatibility requirements



The Dynamic Analysis and Design System (DADS) permit engineers to completely design, model and test a vehicle before it is ever built.

http://www.fmtvtruck.com/

M&S in Acquisition

Production and Deployment

Review M&S Requirements & Products Being Used

T&E
Use M&S to quantify test conditions,
Design tests, and
Predict, quantify & extrapolate test results

"Continue" VV&A Activities
Coordinate with repository for M&S
Use production planning
Use manufacturing process and DPD models
Use factory simulations

Logistics Planning
Use M&S to identify logistics support tasks & requirements
Complete support plans

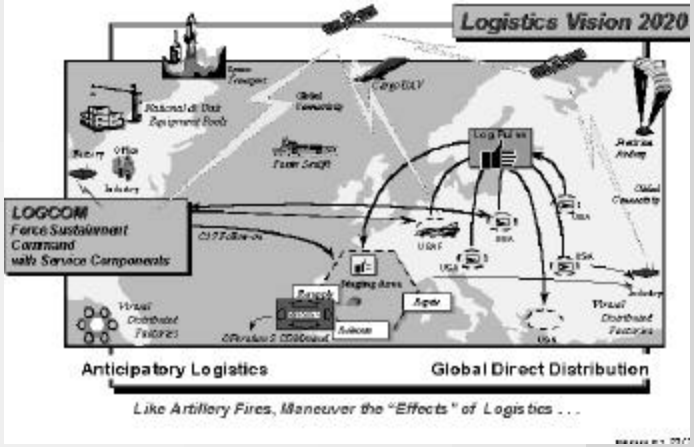
STORM (Simulation Training Operations Rehearsal Model) a federation of 14 models allowed test size to expand from Brigade minus to Division plus through simulation

www.cdt.com/fs31pr.html

M&S in Acquisition

Operations and Support

- Update manufacturing process models & factory simulations
- Use operations, support tracking & prediction models
- Update M&S tools for FOT&E
- Provide M&S applications descriptions to repository
- Evaluate operations & support deficiencies
- Analyze alternative corrective actions
- Training and Education



The Optimum Stockage Requirements Analysis Program (OSRAP) quantifies tradeoffs in cost/weight/cube versus readiness when planning contingency packages for fielded equipment

http://lrc3.monmouth.army.mil/cecom/lrc/leo/eladiv/logistics/modeling/osrap.html

SMART GUIDELINES

- Overview of SMART
- Simulation Support Plan
- How SMART is applied in Functional Areas
- Special Considerations
  - High Level Architecture
  - Using M&S to Stimulate C4I Systems
  - Synthetic Natural Environment
  - Contracting Implications
- Configuration Management (CM)
- Verification, Validation and Accreditation (VV&S)

Army Model and Simulation Office (AMSO) Homepage:
http://www.amso.army.mil/documents/smart/guidelines

Sources of Information

- Modeling and Simulation Information Analysis Center (MSIAC) http://www.msiac.dmso.mil
- SMART Conference http://www.amso.army.mil/smart/conference
- Simulation Interoperability Standards Organization (SISO) http://www.sisostds.org
  - Simulation Interoperability Workshops (SIW) - March and September in U.S., June in Europe; Computer Generated Forces Conference, more.
- Industry/Interservice Training Simulation and Education Conference (I/ITSEC) http://www.iitsec.org
- International Test and Evaluation Association (ITEA) http://www.itea.org/events/index.html

Summary

- Several types of simulations, including virtual, constructive, and live can be used alone or in combination to support acquisition.

- Modeling and Simulation can support acquisition tasks in all phases of the acquisition cycle.

- SMART is the Army model for Simulation Based Acquisition, and requires changes in the culture, environment and processes of the Acquisition lifecycle.